# C.A 1110

**Lux meter**

Measure up

Thank you for purchasing this **C.A 1110 lux meter**.
For best results from your instrument:
- **read** these operating instructions carefully,
- **comply** with the precautions for use.

| | |
|---|---|
| **i** | Information or useful tip. |
| ⊟⊕ | Battery. |
| 🧲 | Magnet. |
| ♲ | The product is declared recyclable following an analysis of the life cycle in accordance with standard ISO 14040. |
| ♻ | Chauvin Arnoux has adopted an Eco-Design approach in order to design this appliance. Analysis of the complete life-cycle has enabled us to control and optimize the effects of the product on the environment. In particular this appliance exceeds regulation requirements with respect to recycling and reuse. |
| CE | The CE marking indicates conformity with European directives, in particular LVD and EMC. |
| 🗑 | The rubbish bin with a line through it indicates that, in the European Union, the product must undergo selective disposal in compliance with Directive WEEE 2002/96/EC. This equipment must not be treated as household waste. |

# PRECAUTIONS FOR USE

This instrument is compliant with safety standard IEC 61010-2-030, for voltages up to 5 V with respect to ground. Failure to observe the safety instructions may result in electric shock, fire, explosion, and destruction of the instrument and of the installations.

- The operator and/or the responsible authority must carefully read and clearly understand the various precautions to be taken in use. Sound knowledge and a keen awareness of electrical hazards are essential when using this instrument.
- Observe the conditions of use, namely the temperature, the relative humidity, the altitude, the degree of pollution, and the place of use.
- Do not use the instrument if it seems to be damaged, incomplete, or poorly close.
- Before each use, check the condition of the insulation on the leads, housing, and accessories. Any item of which the insulation is deteriorated (even partially) must be set aside for repair or scrapping.
- All troubleshooting and metrological checks must be done by competent, accredited personnel.

# CONTENTS

# 1. FIRST USE

## 1.1. DELIVERY CONDITION

**C.A 1110 lux meter**
Supplied in a cardboard box with:
- three AA or LR6 alkaline batteries,
- one USB-micro USB cord,
- one multilingual getting started guide,
- one multilingual safety data sheet,
- one test report,
- one carrying case.

## 1.2. ACCESSORIES

- Multi-purpose attachment accessory
- Carrying bag.
- USB-Bluetooth adapter
- USB-mains adapter with USB-micro USB cord.
- Protecting sheath
- DataView application software
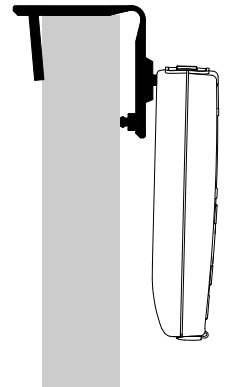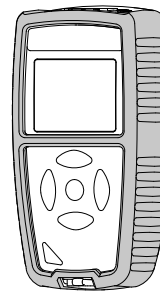
## 1.3. SPARE PARTS

- USB-micro USB cord

For the accessories and spares, consult our web site:
www.chauvin-arnoux.com

## 1.4. INSERTING THE BATTERIES

Notches to hang up the instrument.

Non-skid pads

Magnet for attachment to a metallic surface.

Battery compartment cover.

- Press the tab of the battery compartment cover and lift it clear.
- Withdraw the battery compartment cover.
- Insert the new batteries, paying attention to the polarity.
- Close the battery compartment cover; make sure that it is completely and correctly closed.

# 2. PRESENTATION OF THE INSTRUMENT

## 2.1. C.A 1110

Spiral-wound cable used to remote the illumination sensor.

Cover protecting the sensor (captive).

Illumination sensor.

Magnets used to secure the sensor to the measurement housing.

Backlit LCD display unit.

Keypad with 5 keys.

On/Off key.

Type B micro-USB connector.
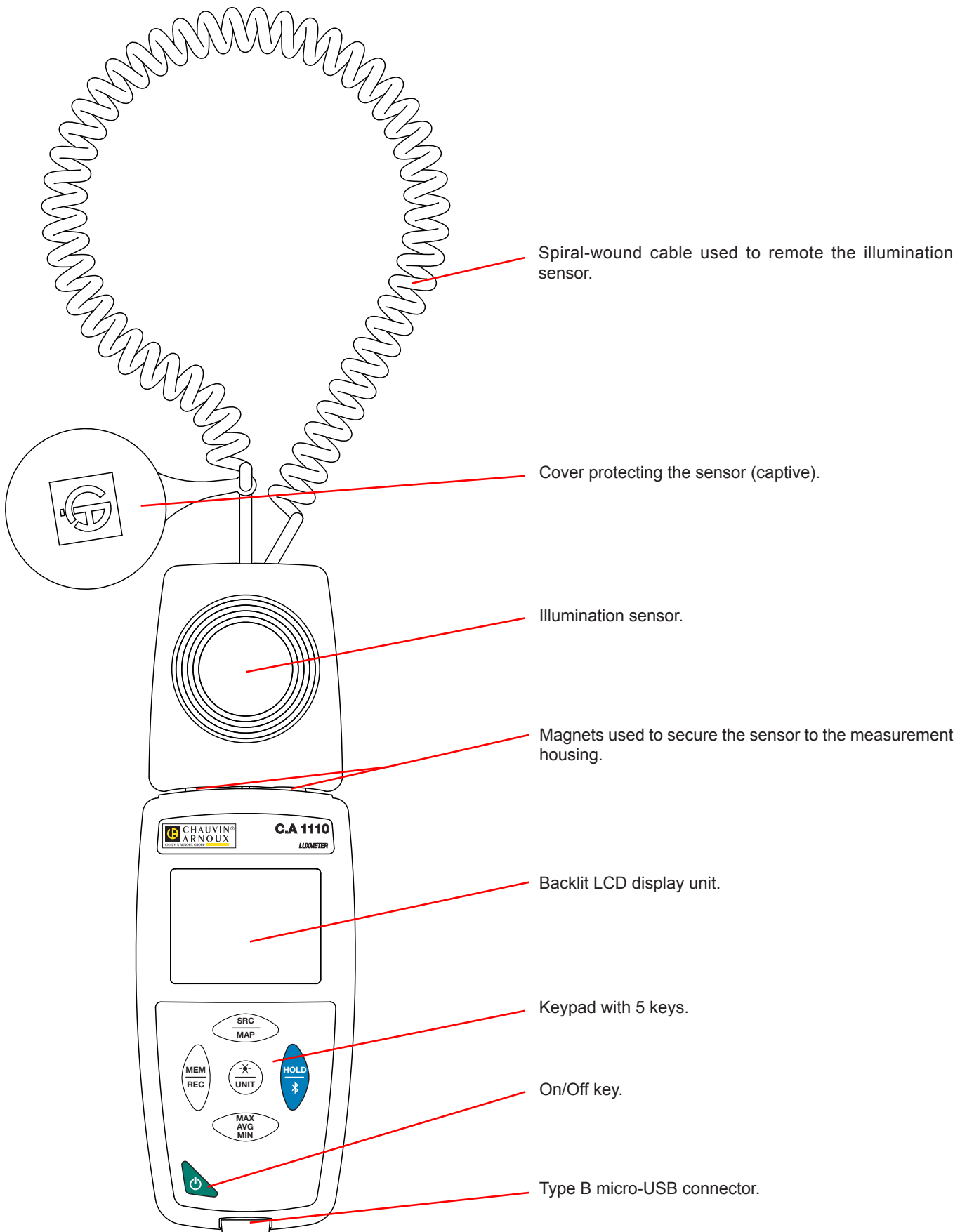
## 2.2. FUNCTIONS OF THE INSTRUMENT

The C.A 1110 is a lux meter. It is used to make illumination measurements from 0.1 to 200,000 lux, in the visible part of the spectrum, to the exclusion of electromagnetic radiation that is not visible (X rays, ultraviolet, infrared, microwaves, RF, audio frequencies, etc.).

It is used to check the illumination on work surfaces or traffic zones, in accordance with the recommendations of the AFE (Association Française de l'Éclairage - French Association of Illumination). Sound management of illumination saves energy.
The instrument can also measure the decrease of illumination over time due to the aging of luminaires and to the dust that is deposited on them. The luminaires can then be cleaned or replaced before the illumination falls below the minimal allowed threshold. This preventive maintenance serves to preserve good visual comfort.

This instrument is easy to use. It has extensive stand-alone capabilities and can be used:
■ to display illumination measurements in lux (lx) or in foot-candles (fc),
■ to record a minimum, an average (mean), and a maximum in a specified period,
■ to record a minimum, an average (mean), and a maximum on a surface or in a room,
■ to record the measurements,
■ to communicate with a PC via a Bluetooth link or a USB cable.

The Data Logger Transfer software can be installed on a PC and is used to configure the instruments and to recover the recorded measurements.

## 2.3. FUNCTION KEYS

| Key | Function |
|---|---|
| SRC / MAP | ■ A short press on the **SRC** key serves to select the type of illumination source: F11 fluorescent, LED, or other source (default). See §8.1.<br>■ A long press on the **MAP** key is used to enter the MAP mode. |
| MEM / REC | ■ A short press on the **MEM** key records the measurement and the date.<br>In MAP mode, pressing the **MEM** key adds a measurement to the measurements of the MAP.<br>■ A long press on the **REC** key starts or stops a recording session. |
| ☀ / UNIT | ■ A short press on the ☀ key switches on the back-lighting.<br>■ A long press on the **UNIT** key displays the measurement either in lux (lx) or in foot-candles (fc). |
| HOLD / ✳ | ■ A short press on the **HOLD** key freezes the display.<br>■ A long press on the ✳ key activates or deactivates the Bluetooth link. |
| MAX AVG MIN | ■ A short press on the **MAX AVG MIN** key opens the MAX AVG MIN mode; the current values continue to be displayed.<br>■ A second press displays the maximum value.<br>■ A third press displays the average (mean) value.<br>■ A fourth press displays the minimum value.<br>■ A fifth press results in a return to the first-press condition and display of the current values<br>■ A long press is used to exit from the MAX AVG MIN mode.<br><br>In the MAP mode, presses on the **MAX AVG MIN** key display in turn the maximum, average (mean), and minimum of the MAP measurements. |

## 2.4. ON/OFF KEY

A long press on the ⏻ key switches the instrument on.

A second long press on the ⏻ key switches the instrument off when it is on.
However, it is not possible to switch the instrument off when it is in record mode and is recording.
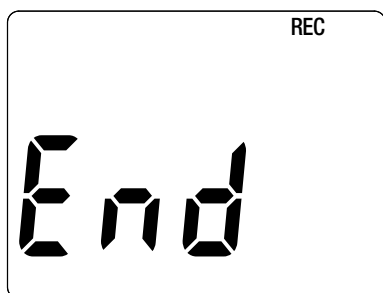


If during start-up the instrument displays the screen shown opposite, it means that a recording session has been brutally interrupted by a power outage.

During the display of this screen, the instrument recovers the recorded data. The longer the record, the longer the recovery. Do not interrupt the recovery or the data will be lost.

## 2.5. DISPLAY
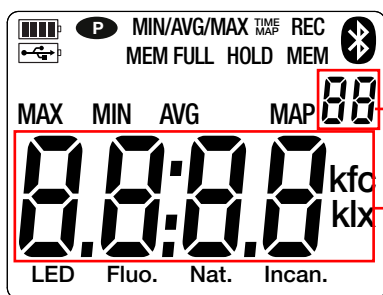


MAP function counter.

Main display unit.

When the measurement exceeds the limit, the instrument displays OL.

**P**: indicates that auto-off is disabled and the instrument is in permanent mode.
This occurs when:
■ the instrument is recording, in MAX AVG MIN mode, in MAP mode, or in HOLD;
■ the instrument is connected via the USB cord either to an external power supply or for communication with a PC;
■ the instrument is in communication via Bluetooth;
■ or auto-off is disabled (see §4.5.3).

# 3. USE IN STAND-ALONE MODE

The instrument can operate in two modes:
- the stand-alone mode described in this section,
- the record mode, in which it is controlled by a PC. This mode is described in the next section.

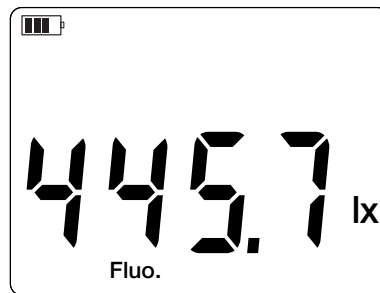## 3.1. MEASUREMENT OF ILLUMINATION

- Remove the cap protecting the sensor.
- Long-press the ⏻ key to switch the instrument on.

The instrument displays the time, then the measurement. The time is set using the Data Logger Transfer software (see §4).

- To display the measurements in foot-candles (fc), long-press the **UNIT** key. The instrument will continue to use this unit when next switched on.
- Choose the type of light source (see §8.1):
    - **LED**: this is the light from LED lamps.
    - **Fluo.** (fluorescent): this is the light from type F11 fluorescent tubes. This setting improves measurement accuracy with this type of source. If the light is from fluorescent tubes of a different or unknown type, it is preferable to use the default mode.
    - Other sources: this is the default light source. Nothing is indicated on the display unit.
- Place the sensor on the surface on which you wish to know the illumination. Take care not to throw off the measurement by placing yourself between the sensor and the light source(s).
- Record the measurement.

445.7 lx
Fluo.

| ℹ️ | The sensor has no memory effect and is not dazzled, so you can make a low-illumination measurement just after a very-high-illumination measurement. |

Refer to appendix § 8.2 for the commonest illumination values.

## 3.2. OTHER FUNCTIONS

### 3.2.1. HOLD FUNCTION

Pressing the **HOLD** key freezes the display. A second press unfreezes it.

### 3.2.2. MAX AVG MIN FUNCTION

The MAX AVG MIN function is used to monitor the evolution of the illumination over time.

Pressing the **MAX AVG MIN** key activates the function and starts recording of the extrema and calculation of the mean.

Press the **MAX AVG MIN** key a second time and the instrument displays the maximum. Press it a third time and the instrument displays the mean. A fourth time and the instrument displays the minimum. A fifth time and it returns to the current value.
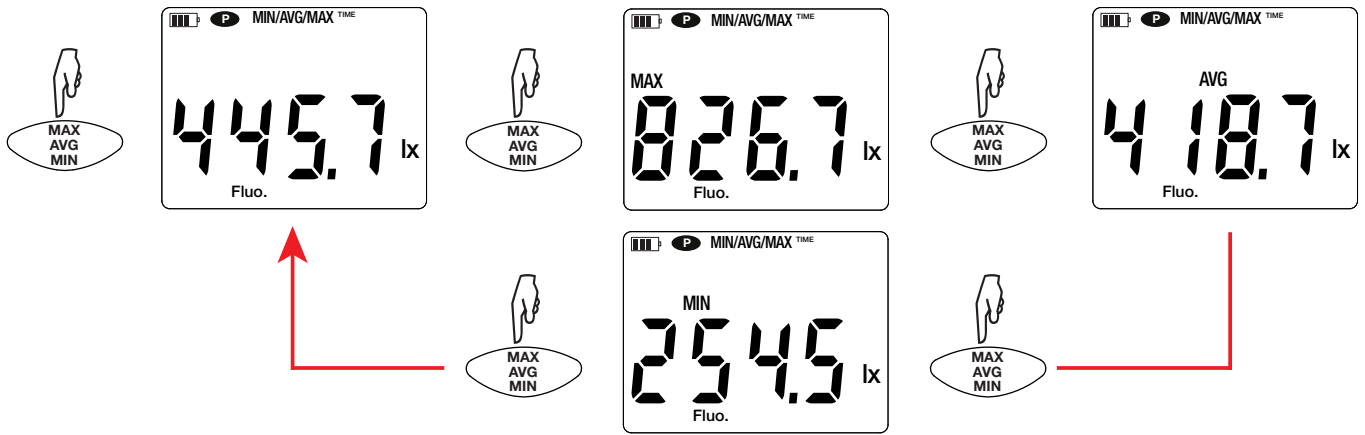
To exit from the MAX AVG MIN mode, long-press the **MAX AVG MIN** key.

### 3.2.3. MAP FUNCTION

The MAP function is used to map the illumination on a surface or in a room.

A long press on the **MAP** key activates the function. The counter of the number of points recorded reads zero.

Plot the map of the room and situate the measurement points.
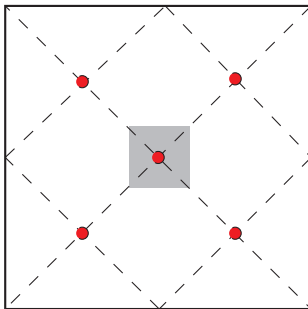


Here's an example of 2 rooms.
The ▢ represent the luminaires.
The ⬤ represent the measurement points.
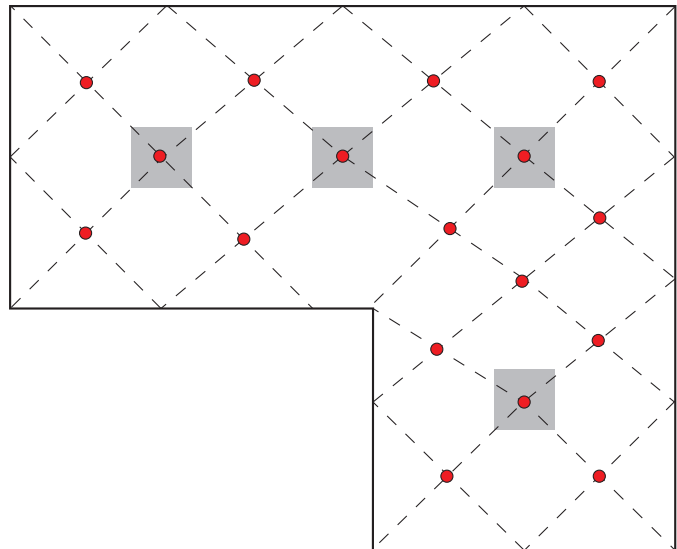
Refer to §4.4 of standard NF EN 12464-1 to establish a map in conformity with good practice.

Place the sensor on the first measurement point and press the **MEM** key to record the value in memory. The counter is incremented.
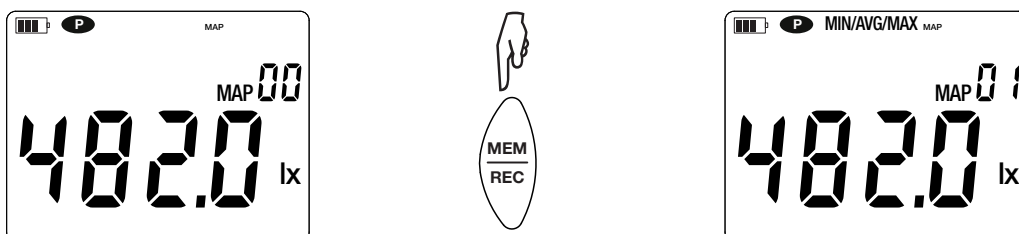


Proceed in the same way for all the other points of the map.

When all of the points have been entered, you can look up the maximum, the mean, and the minimum of the values entered. To do this, press the **MAX AVG MIN key 3 times.**

To exit from the MAP mode, long-press the **MAP** key.

For each map measurement, a file is created with all of the measurement points. This file can then be recovered for analysis.

## 3.3. RECORDING THE MEASUREMENTS

- A short press on the **MEM** key records the measurement and the date.
- A long press on the **REC** key starts or stops a recording session.

To see the records, you must use a PC and install the Data Logger Transfer software (see §4).

## 3.4. ERRORS

The instrument detects errors and displays them in the form Er.XX. The main errors are the following:

Er.01: Hardware malfunction detected. The instrument must be sent in for repair.
Er.02: Error in internal memory. Format it using Windows.
Er.03: Hardware malfunction detected. The instrument must be sent in for repair.
Er.10: The instrument has not been adjusted or is not correctly adjusted. The instrument must be sent back to customer service.
Er.11: The update of the internal software is not compatible with the instrument (the software is that of another instrument of the line). Install the correct internal software in your instrument.
Er.12: The update of the internal software is not compatible with the electronic boards in the instrument. Reload the previous internal software into your instrument.
Er.13: Recording scheduling error. Check that the instrument's time and the time of the Data Logger Transfer software are the same.

# 4. USE IN RECORDING MODE

The instrument can operate in two modes:
■ the stand-alone mode described in the previous section,
■ the record mode, in which it is controlled by a PC. This mode is described below.

## 4.1. CONNECTION

The device has 2 communication modes:
■ A USB link via a USB-micro USB cord,
■ A Bluetooth 4.0 BLE wireless link.

## 4.2. GET DATA LOGGER TRANSFER SOFTWARE

Visit our web site to download the latest version of the application software:
www.chauvin-arnoux.com

Go to the **Support** tab, then **Download our software**. Then search on the name of your instrument.

Download the software, then install it on your PC.

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| i | You must have administrator privileges on your PC to install the Data Logger Transfer software. |

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**Minimum computer requirements:**
■ Windows 7 (32/64 bits)
■ 2 GB of RAM
■ 200 MB of disc space

Windows® is a registered trade mark of Microsoft®.

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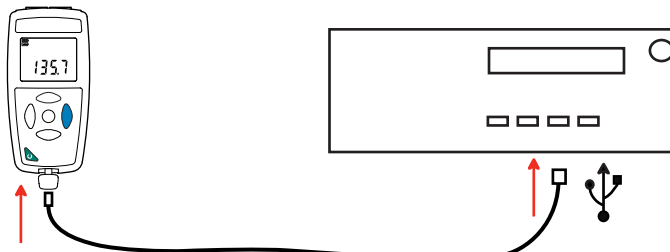| i | Do not connect the instrument to the PC until you have installed the Data Logger Transfer software. |

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## 4.3. USB LINK

Long-press the ⏻ key to switch the instrument on.

Once the Data Logger Transfer software has been installed, connect the instrument to the PC.



It is treated as a USB key and you can access its content. But to read the records, you must use the Data Logger Transfer software.
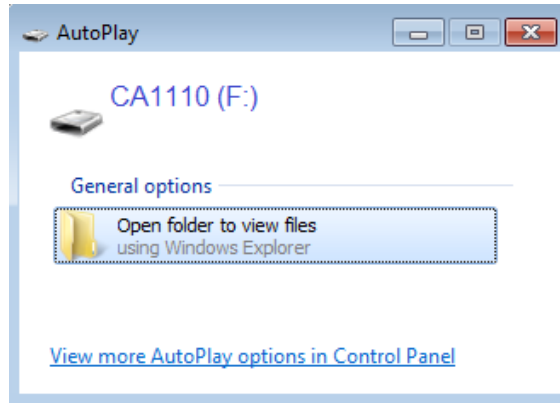
## 4.4. BLUETOOTH LINK

The instrument has a low-energy Bluetooth 4.0 link that requires no pairing.

■ Activate Bluetooth on your PC. If your PC does not have a Bluetooth link, you can add a board or Bluetooth adapter connected to a USB port (see §1.2).

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| i | Since Windows 7 does not manage low-energy Bluetooth, a specific USB/Bluetooth adapter must be used (see §1.2).

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■ Switch the instrument on by a long press on the ⏻ key, then activate the Bluetooth link by a long press on the ᛒ key. The ᛒ symbol is displayed.

■ The instrument is then ready to communicate with the PC.

## 4.5. DATA LOGGER TRANSFER SOFTWARE

Once the instrument has been connected to the PC, whether by USB or by Bluetooth, open the Data Logger Transfer software.

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| i | For context-sensitive information about the use of the Data Logger Transfer software, refer to the **Help** menu**.**

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### 4.5.1. CONNECTING THE INSTRUMENT

■ To connect an instrument, click **Add an instrument**, then choose the type of connection (USB or Bluetooth).

■ A window opens with a list of all instruments connected to the PC.
The name of the instrument will be formed from the model of the instrument and the warranty number: CA 1110 - 123456ABC
You can personalize your instrument by adding a name and a location, by clicking on 🛠 or 🔧 .

■ Choose your instrument in the list. The software then displays complete information about the instrument and its measurements in progress.
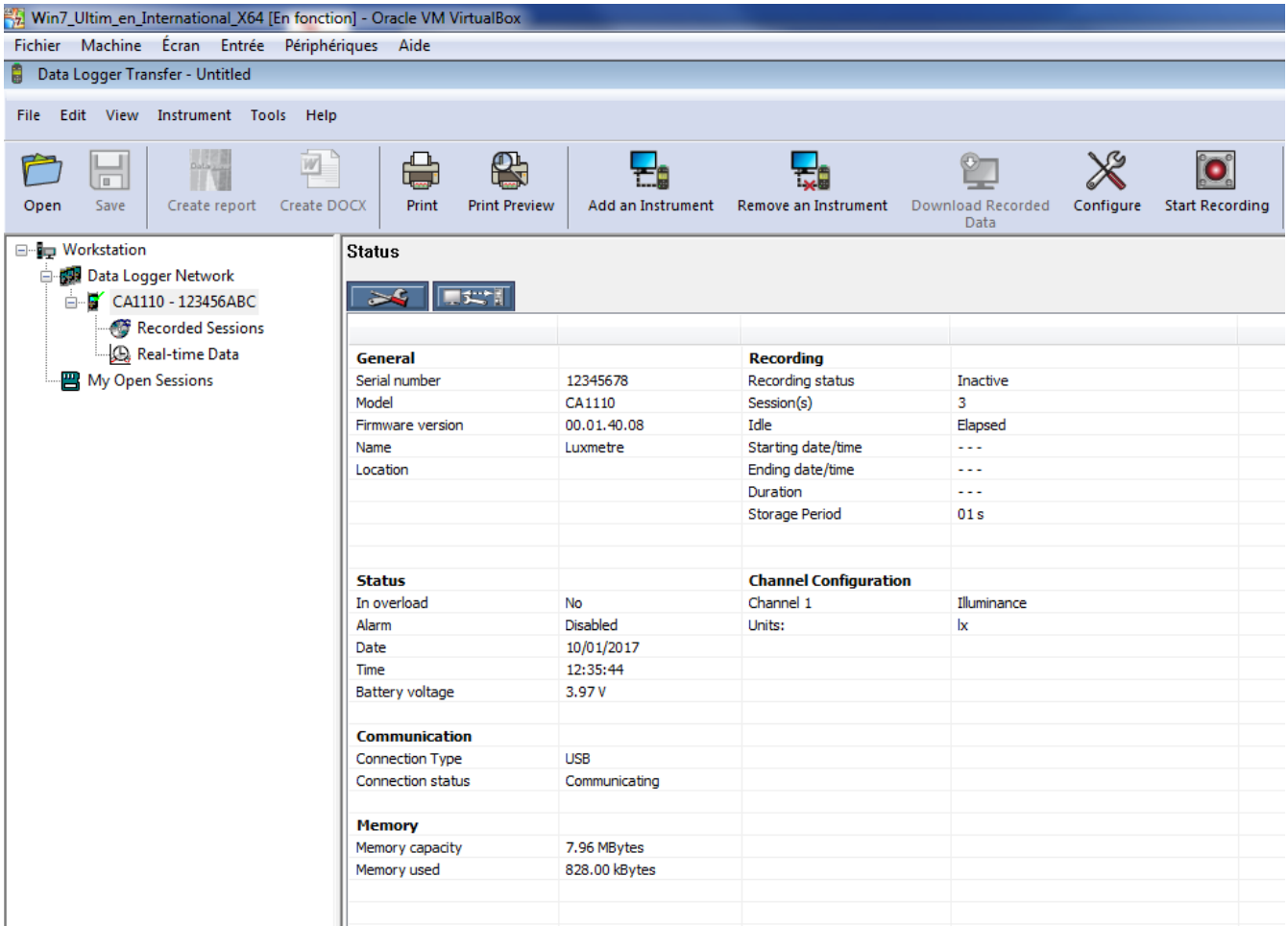
## 4.5.2. DATE AND HOUR

The **Instrument** menu 🕐 lets you set the your instrument's date and time.
These cannot be changed while recording or when a recording session has been scheduled.
By clicking ✖, you can choose the date and time display formats.

## 4.5.3. AUTO OFF

As default, the instrument switches itself off automatically after 3 minutes of operation without the user's presence being confirmed by a key-press. By clicking ✖, you can change this value to 3, 10, or 15 minutes.

It is also possible to disable this auto-off function; the instrument then displays the **P** symbol.

## 4.5.4. PROGRAMMED RECORDING SESSIONS

By clicking 🔴, you can program a recording session. Assign a name to the recording session. Then enter a starting date and time and an ending date and time or a duration. The maximum duration of a recording session depends on the memory available.

Choose a sampling period. The possible values are: 1 s, 2 s, 5 s, 10 s, 20 s, 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 30 min and 1 hour. The shorter the sampling period, the larger the recorded file.

Before and after the recording session, if the instrument is switched on, the sampling period will be that of the stand-alone mode (1s).

If the instrument is off when recording starts, it switches itself on by itself. Then it displays the measurement, which it refreshes at each sampling period.

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ℹ️  Before starting a recording session, make sure that the battery life is sufficient, or else connect the instrument to an external power supply to a wall outlet using a micro USB cord.

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### 4.5.5. DISPLAY

By clicking ![wrench icon], then opening to the **Luxmeter** tab, you can modify the display of the measurements on the instrument in the same way as by pressing the **SRC** key, or the **UNIT** key.

### 4.5.6. READING THE RECORDS

The Data Logger Transfer software lets you read the records made. Click **Recorded Sessions** under the name of your instrument to obtain a list of the records.



### 4.5.7. EXPORTING RECORDS

Once the list of the records is displayed, choose the one you want to export and convert it into a word-processing document (docx) or a spreadsheet (xlsx), in order to be able to use it in the form of reports or curves.

It is also possible to export the data to the DataView application software (see §1.2).

### 4.5.8. REAL-TIME MODE

Click **Real-time data** under the name of your instrument to see the measurements being made on the instrument as they are made.

### 4.5.9. FORMATTING THE MEMORY OF THE INSTRUMENT

The internal memory of the instrument is already formatted. But if there is a problem (if it becomes impossible to read or to write), it may be necessary to reformat it (in Windows).

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ⓘ     In this case, all of the data will be lost.

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# 5. TECHNICAL CHARACTERISTICS

## 5.1. REFERENCE CONDITIONS

| Quantity of influence | Reference values |
|---|---|
| Temperature | 23 ± 2°C |
| Relative humidity | 45% to 75% |
| Supply voltage | 3 to 4.5V |
| Light source | illuminant A |
| Electric field | < 1V/m |
| Magnetic field | < 40A/m |

The intrinsic uncertainty is the error specified for the reference conditions.

## 5.2. OPTICAL CHARACTERISTICS

The illumination sensor is a silicon (Si) photodiode of which the spectral response is corrected by an optical filter. The directional response is ensured by a diffusing lens.

The C.A 1110 is a class C lux meter per standard NF C-42-710.

### 5.2.1. ILLUMINATION MEASUREMENTS

| Specified measurement range | 0.1 to 200,000lx | | | | 0.01 to 18,580fc | | | |
|---|---|---|---|---|---|---|---|---|
| Resolution | 0.1 to 999.9lx | 1.000 to 9.999 klx | 10.00 to 99.99 klx | 100.0 to 200.0 klx | 0.01 to 99.99fc | 100.0 to 999.9fc | 1.000 to 9.999kfc | 10.00 to 18.58kfc |
| | 0.1lx | 1lx | 10lx | 100lx | 0.01fc | 0.1fc | 1fc | 10fc |
| Intrinsic uncertainty on the illumination measurement | 3% of reading | | | | | | | |
| Intrinsic uncertainty on the spectral response with respect to $V(\lambda)$ | $f_1' < 20\%$ | | | | | | | |
| Directional sensitivity | $f_2 < 1,5\%$ | | | | | | | |
| Intrinsic uncertainty on the linearity | $f_3 < 0,5\%$ | | | | | | | |

### 5.2.2. OTHER

| | |
|---|---|
| Sensitivity to UV | u<0.05% (class A) |
| Sensitivity to IR | r<0.005% (class A) |
| Directional response | $f_2$<1.5% (class B) <br> $F_2$<3% (class C) |
| Fatigue, memory effect | $f_5 + f_{12}$<0.5% (class A) |
| Influence of temperature | $f_6$=0.05%/°C (class A) |
| Response to modulated light | $f_7$(100 Hz)=Influence negligible |
| Response to polarization | $f_8(\varepsilon)$=0.3 % |
| Response time | 1s |

### 5.2.3. SPECTRAL RESPONSE CURVE V($\lambda$),

The light we see is electromagnetic radiation having a wavelength between 380nm and 780nm.

The response curve of the eye as a function of wavelength has been determined by the IEC (International Electrotechnical Commission). This is the V($\lambda$) curve, or relative spectral luminous efficiency curve for photopic vision (daytime vision).

Relative luminous efficiency



V($\lambda$) photopic vision
$\lambda$m = 555 nm
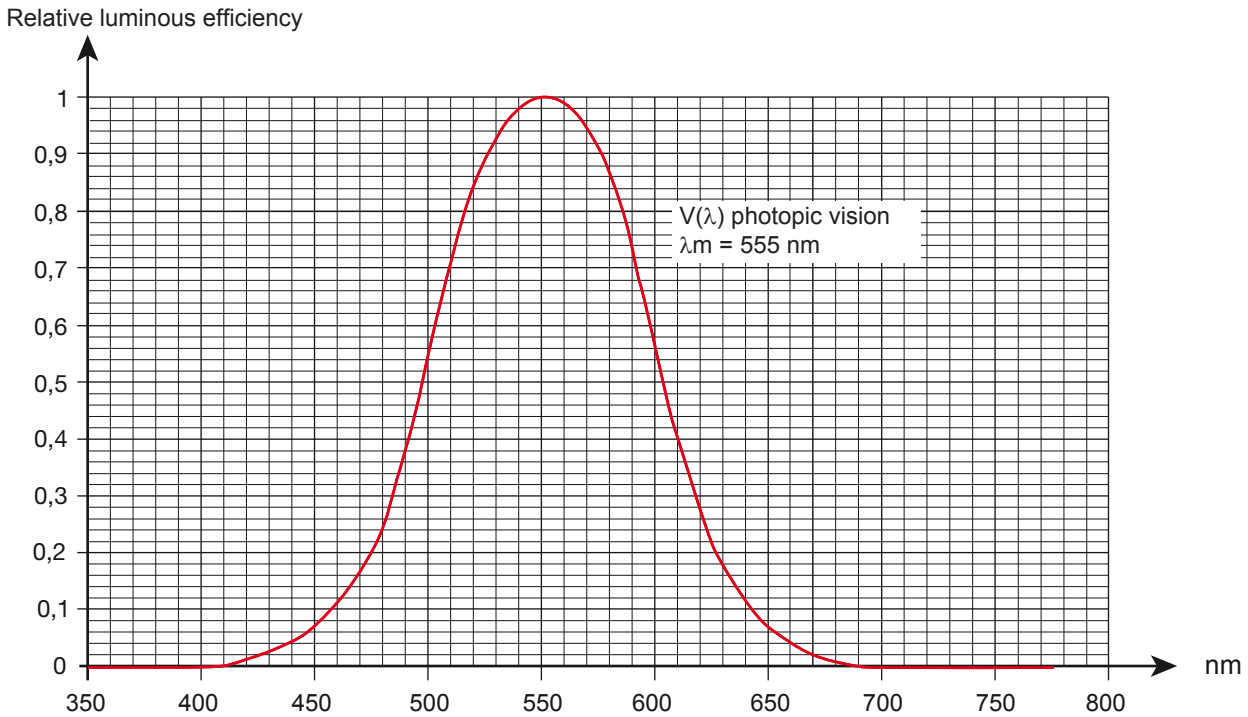
The error on the spectral response of the sensor is equal to the area of the differences between the V($\lambda$) curve and the curve of the sensor.

### 5.2.4. VARIATION ACCORDING TO THE TYPE OF LIGHT SOURCE

The C.A 1110 provides 3 measurement compensations:
- Illuminant A (default).
- LED at 4000°K
- Fluorescent of type F11

The LED compensation is provided for measurements on LEDs at 4000°K. The intrinsic uncertainty in this case is 4%. If this compensation is used for other LEDs, the intrinsic error is increased as indicated in the table below.

The FLUO compensation is provided for measurements on type F11 fluorescent sources. The intrinsic uncertainty in this case is 4%. If this compensation is used for other fluorescent sources, the intrinsic error is increased as indicated in the table below.

| Quantities of influence | Range of influence | Quantity influenced | Influence |
|---|---|---|---|
| Type of light source | LED 3,000 to 6,000K | Illumination | The intrinsic uncertainty is increased by 3% (for a total of 6%) |
| | Fluorescents of types F1 to F12 | | The intrinsic uncertainty is increased by 6% (for a total of 9%) |

Refer to §8.1 for the curves of the illuminants.

## 5.3. MEMORY

The size of the flash memory containing the records is 4 MB.

This capacity is sufficient to record a million measurements. At each measurement, the illumination is recorded with the date, the time and the unit.

## 5.4. USB

Protocol: USB Mass Storage
Maximum transmission speed: 12 Mbit/s
Type B micro-USB connector

## 5.5. BLUETOOTH

Bluetooth 4.0 BLE
Range 10m typical and up to 30m in line of sight.
Output power: +0 to -23 dBm
Nominal sensitivity: -93 dBm
Maximum transfer rate: 10 kbits/s
Average consumption: 3.3 µA to 3.3 V.

## 5.6. POWER SUPPLY

The instrument is supplied by three 1.5V LR6 or AA alkaline batteries. It is possible to replace the batteries by rechargeable NiMH batteries of the same size. But the rechargeable batteries, even when correctly charged, will not reach the voltage of the alkaline batteries and the life indicated will be ▮▮▮ or ▮▮.

The voltage range ensuring correct operation is from 3 to 4.5V for the alkaline batteries and 3.6V for the rechargeable batteries.

Below 3V, the instrument stops making measurements and displays BAt.

Battery life (with the Bluetooth connection deactivated) is:
■ in stand-alone mode, 500h
■ in recording mode: 3 years at rate of one measurement every 15 minutes.

The instrument can also be powered via a USB-micro USB cord, connected either to a PC or to a wall outlet via a mains adapter.



> 110 $V_{AC}$
< 240 $V_{AC}$
50 / 60 Hz
2,5 W
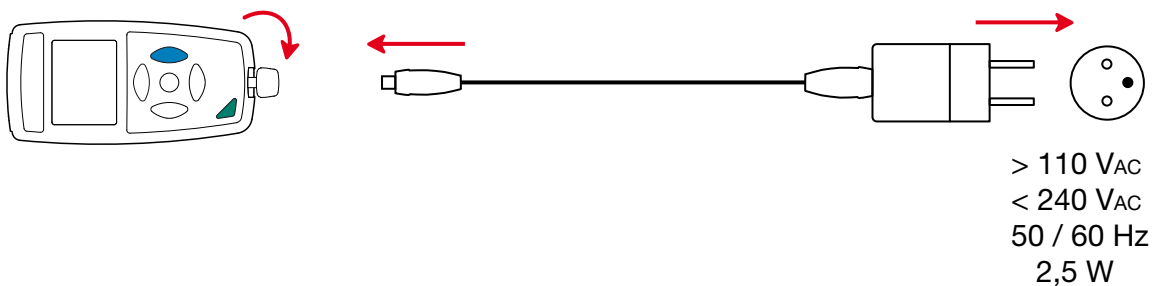
## 5.7. ENVIRONMENTAL CONDITIONS

For use indoors and outdoors.
Operating range        -10 to 60°C and 10 to 90%RH without condensation
Storage range          -20 to +70°C and 10 to 95%RH without condensation, without batteries
Altitude               < 2000m, and 10,000m in storage.
Pollution degree       2

## 5.8. MECHANICAL CHARACTERISTICS

Dimensions (L x W x H)
    Housing              150 x 72 x 32 mm
    Sensor              67 x 64 x 35 mm with the protecting cap
    Spiral-wound cable   24 to 120 cm

Mass                 345 g approx.

Inrush protection       IP 50, with the USB connector closed and the protecting cap on the sensor, per IEC 60.529.

Drop impact test        1 m per IEC 61010-1.

## 5.9. COMPLIANCE WITH INTERNATIONAL STANDARDS

The instrument is compliant with standard IEC 61010-1.

## 5.10. ELECTROMAGNETIC COMPATIBILITY (CEM)

The instrument is compliant with standard IEC 61326-1.

# 6. MAINTENANCE

⚠ **Except for the batteries, the instrument contains no parts that can be replaced by personnel who have not been specially trained and accredited. Any unauthorized repair or replacement of a part by an "equivalent" may gravely impair safety.**

## 6.1. CLEANING

ℹ To preserve good measurement quality, the sensor must be kept perfectly clean.

Switch the instrument off.

Use a soft cloth, dampened with soapy water. Rinse with a damp cloth and dry rapidly with a dry cloth or forced air. Do not use alcohol, solvents, or hydrocarbons.

## 6.2. MAINTENANCE

- Place the protecting cap on the sensor when the instrument is not in use so as to protect the sensor from impacts and dirt.
- Store the instrument in a dry place and at constant temperature.

## 6.3. REPLACEMENT OF BATTERIES

The ▮▮▮▮ symbol indicates the remaining battery life. When the ▭ symbol is empty, all of the batteries must be replaced.

- Disconnect everything connected to the instrument and switch it off.
- Refer to §1.4 for the replacement procedure.

🗑 Spent batteries must not be treated as ordinary household waste. Take them to the appropriate recycling collection point.

## 6.4. UPDATING THE EMBEDDED SOFTWARE

With a view to providing, at all times, the best possible service in terms of performance and technical improvements, Chauvin-Arnoux offers you the possibility of updating the internal software of this instrument by downloading, free of charge, the new version available on our web site.

See you on our site:
www.chauvin-arnoux.com
Then go to "Support", then "Download our software", then "C.A 1110".

ℹ Updating the embedded software may reset the configuration and cause the loss of the recorded data. As a precaution, save the data in memory to a PC before updating the embedded software.
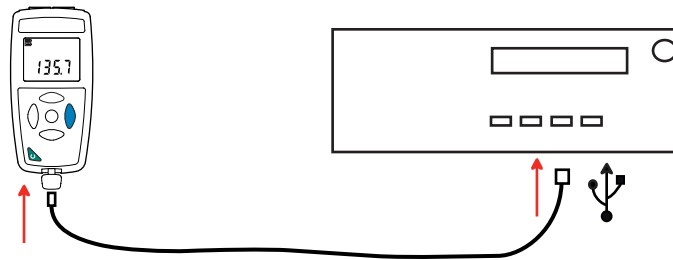
**Embedded software update procedure**

■ Download the .bin file from our web site, then press and hold the MEM key and switch the instrument on by pressing the ⏻ key. The instrument displays BOOT.
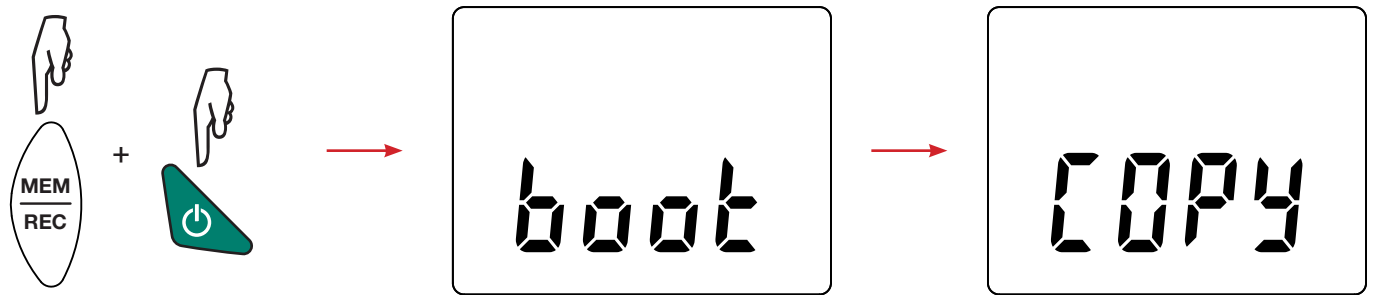


■ Release the keys and the instrument displays COPY, indicating that it is ready to receive the new software.
■ Connect the instrument to your PC using the USB cord provided.



■ Copy the .bin file to the instrument as if were a USB key.
■ When the copying is done, press the **MEM** key and the instrument displays LOAD, indicating that the software is being installed.
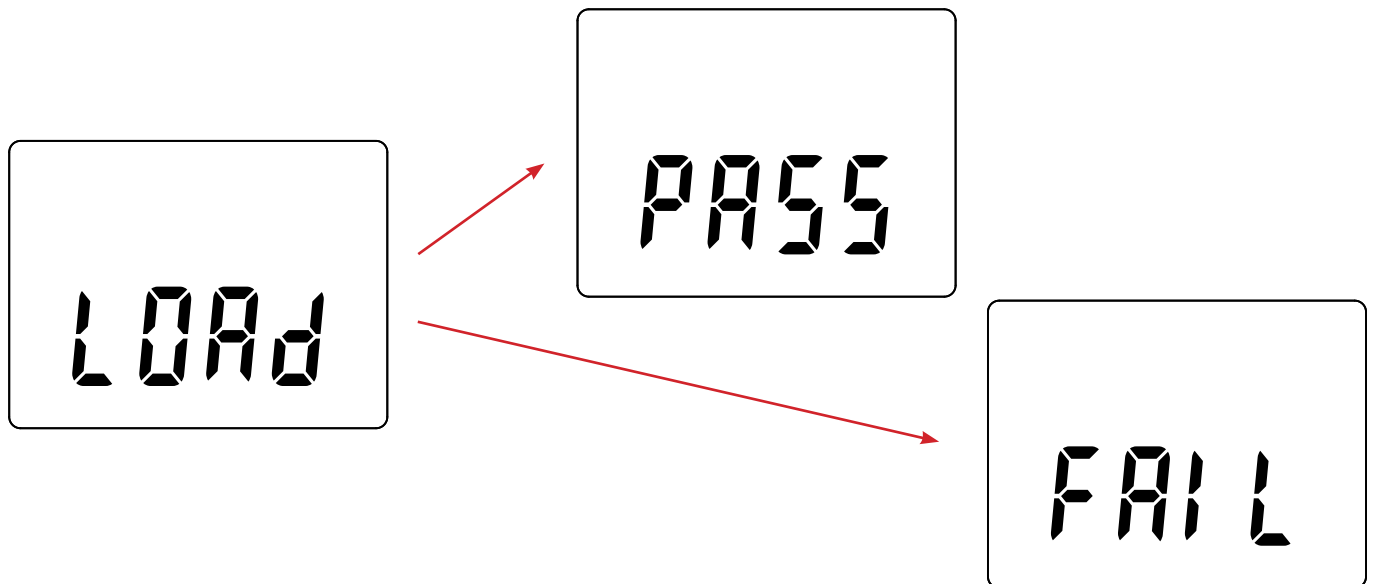


■ When installation is done, the instrument displays PASS or FAIL according to whether or not the operation succeeded. If installation fails, download the software again and repeat the procedure.
■ Then the instrument restarts normally.

| **i** | After the internal software is updated, it may be necessary to reconfigure the instrument; see §4.5. |

# 7. WARRANTY

Except as otherwise stated, our warranty is valid for **24 months** starting from the date on which the equipment was sold. Extract from our General Conditions of Sale provided on request.

The warranty does not apply in the following cases:

- Inappropriate use of the equipment or use with incompatible equipment;
- Modifications made to the equipment without the explicit permission of the manufacturer's technical staff;
- Work done on the device by a person not approved by the manufacturer;
- Adaptation to a particular application not anticipated in the definition of the equipment or not indicated in the user's manual;
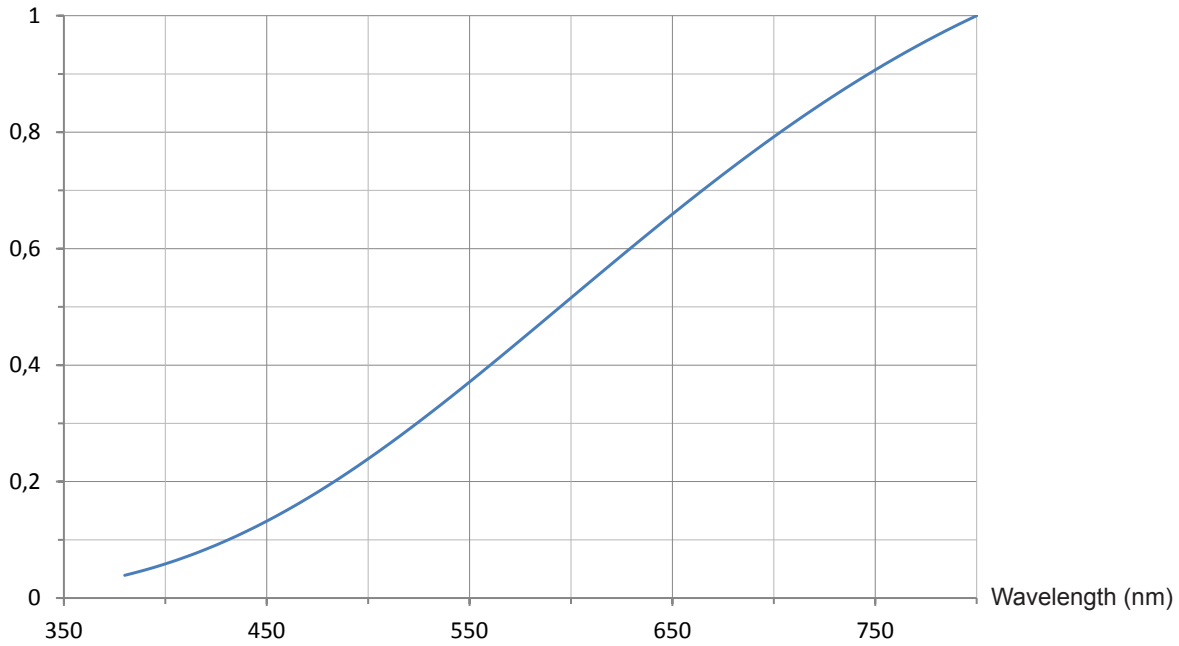- Damage caused by shocks, falls, or floods.

# 8. APPENDIX

## 8.1. ILLUMINANTS

The instrument handles 3 types of illumination source:
- ■ natural or incandescent - illuminant A defined by standard NF C-42-710
- ■ fluorescent tubes with three narrow bands, or F11
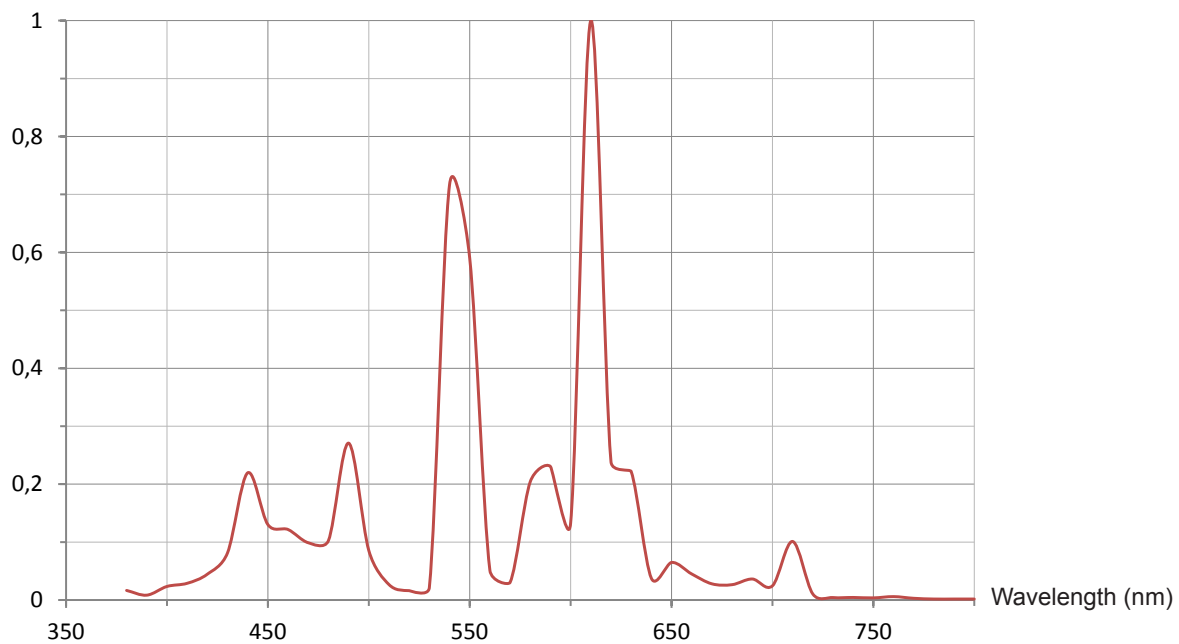- ■ LEDs at 4000K.

### 8.1.1. CURVE OF ILLUMINANT A
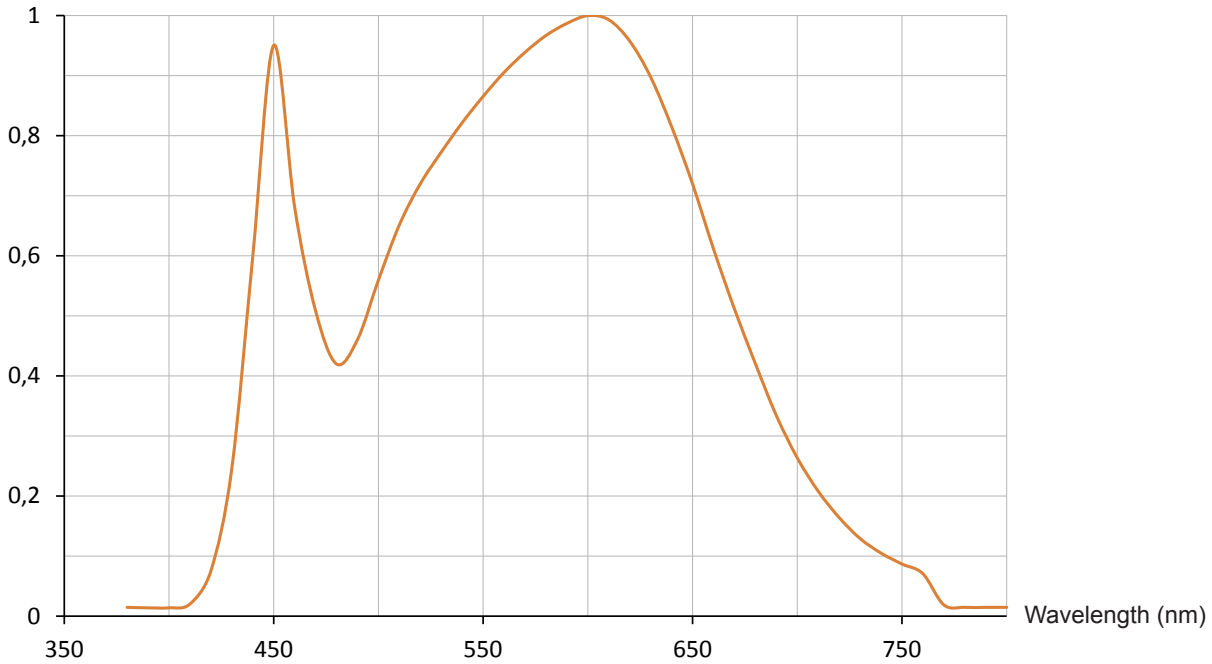
Standardized spectral distribution



### 8.1.2. CURVE OF THE FLUORESCENT ILLUMINANT (F11)

Standardized spectral distribution

**8.1.3. CURVE OF THE LED ILLUMINANT**

Standardized spectral distribution



## 8.2. ILLUMINATION VALUES

| | |
|---|---|
| Total darkness | 0lx |
| Outdoors at night | 2 to 20lx |
| Production plant without manual operations | 50lx |
| Passageways, stairs and corridors, warehouses | 100lx |
| Dock and loading areas | 150lx |
| Changing rooms, cafeteria, and sanitary facilities | 200lx |
| Handling, packaging, and dispatching areas | 300lx |
| Conference and meeting rooms, writing, reading | 500lx |
| Industrial drafting | 750lx |
| Operating room, precision mechanics | 1,000lx |
| Electronics workshop, checks of colours | 1,500lx |
| Operating table | 10,000lx |
| Outdoors, cloudy | 5,000 to 20,000lx |
| Outdoors, clear sky | 7,000 to 24,000lx |
| Outdoors, direct sunlight, summer | 100,000lx |

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